

## WHAT IS CLAIMED IS:

1. A composition comprising a particle including a core and a shell, the core including a metal carbide and the shell including a carbon nanoparticle on at least a portion of a surface of the core.
- 5        2. The composition of claim 1, wherein the metal carbide is silicon carbide.
3. The composition of claim 1, wherein the carbon nanoparticle includes fullerenic carbon.
4. The composition of claim 1, wherein the shell covers at least 50% of a  
10 surface of the core.
5. The composition of claim 1, wherein the particle includes at least 2% by volume carbon nanoparticles.
6. The composition of claim 1, wherein the shell has an average thickness of at least 2.5 nanometers.
- 15       7. The composition of claim 1 wherein the particle has an average diameter of less than 100 micrometers.
8. The composition of claim 1, wherein the carbon nanoparticle includes a single-walled or multi-walled carbon nanotube or a nanofiber chemically attached to the core at at least one end.
- 20       9. The composition of claim 1, wherein the carbon nanoparticle includes a carbon nanotube or carbon nanofiber open at an end.
10. The composition of claim 1, further comprising a coating of metal or metal oxide on the carbon nanoparticle.
11. A composite abrasive particle comprising a core and a shell, the core  
25 including a metal carbide and the shell including a carbon nanoparticle on at least a portion of a surface of the core.
12. The composite abrasive particle of claim 11, further comprising a coating of metal or metal oxide on the carbon nanoparticle.

13. A grinding or finishing product comprising the particle of claim 1.
14. The product of claim 13, wherein the metal carbide is silicon carbide.
15. The product of claim 13, wherein the product is a grinding wheel, a cutting wheel, a coated abrasive or a suspension of abrasive particles in a liquid.
- 5 16. A structurally reinforced composite comprising the particle of claim 1.
17. The composite of claim 16, wherein the metal carbide is silicon carbide.
18. An electrochemical storage medium comprising the particle of claim 1.
19. A hydrogen storage medium comprising the particle of claim 1.
- 10 20. The storage medium of claim 18 or 19, wherein the metal carbide is silicon carbide.
21. A composition comprising a particle including substantially densely-carbon nanoparticles.
22. The composition of claim 21, wherein the carbon nanoparticles include  
15 fullerenic carbon.
23. The composition of claim 21, wherein the carbon nanoparticles include a single-walled or multi-walled carbon nanotube or a nanofiber.
24. The composition of claim 23, wherein at least one end of the nanotube or nanofiber is closed.
- 20 25. The composition of claim 23, wherein at least one end of the nanotube or nanofiber is open.
26. The composition of claim 21, further comprising a coating of metal or metal oxide on the carbon nanoparticles.
27. An abrasive particle comprising substantially densely-packed carbon  
25 nanoparticles.
28. The particle of claim 27, further comprising a coating of metal oxide or metal on the carbon nanoparticles.

29. A grinding or finishing product comprising the composition of claim 21.
30. The product of claim 29, wherein the product is a grinding wheel, cutting wheel, coated abrasive, or suspension of abrasive particles in a liquid.
- 5 31. A structurally reinforced composite comprising the composition of claim 21.
32. An electrochemical storage medium comprising the composition of claim 21.
33. A hydrogen storage medium comprising the composition of claim 21.
- 10 34. A method of manufacturing an article including a carbon nanoparticle on a surface of the article comprising:
- heating an article including a metal carbide in a first atmosphere for a period of time to generate at least one carbon nanoparticle nucleus on the surface of the article, the first atmosphere being an oxidizing atmosphere relative to the metal carbide; and
- 15 heating the article including at least one carbon nanoparticle nucleus in a second atmosphere to grow the carbon nanoparticles on the surface of the article.
35. The method of claim 34, wherein the second atmosphere includes an inert gas.
- 20 36. A method of manufacturing an article including a carbon nanoparticle on a surface of the article comprising:
- heating an article including a metal carbide in an oxygen-containing gas atmosphere at a temperature at which the metal carbide is in an active oxidation regime and carbon is in a graphite stability regime.
- 25 37. The method of claim 34 or 36, wherein the atmosphere includes CO or a mixture of CO and CO<sub>2</sub>.
38. A method of manufacturing an article including a carbon nanoparticle on a surface of the article comprising heating an article including a metal carbide in an inert gas atmosphere at a temperature between 1000 °C and 2000 °C.

39. The method of claim 38 wherein the inert gas includes a gas selected from the group of helium, hydrogen, argon, and a nitrogen-hydrogen mixture.

40. The method of claim 38, further comprising heating the article including the metal carbide to nucleate a carbon nanoparticle prior to heating the  
5 article including the metal carbide in an inert gas atmosphere at a temperature between 1000 °C and 2000 °C.

41. The method of claim 34, 36, or 38, wherein the carbon nanoparticle includes fullerenic carbon.

42. The method of claim 34, 36, or 38, wherein the metal carbide is silicon  
10 carbide.

43. The method of claim 34, 36, or 38, wherein the pressure is greater than  $10^{-3}$  Torr.

44. The method of claim 34, 36, or 38, wherein the pressure is greater than  $10^{-2}$  Torr.

45. The method of claim 34, 36, or 38, wherein the temperature is between  
15 1200 °C and 2000 °C.

46. A method of forming a composite comprising:  
dispersing carbon nanoparticles in a matrix including an oxide of a first  
metal; and  
20 contacting the matrix with a reducing agent to reduce the oxide of the first metal.

47. The method of claim 46, wherein the reducing agent is a second metal.

48. The method of claim 46, wherein the first metal is copper, iron, lead,  
nickel, cobalt, tin, zinc, sodium, chromium, manganese, tantalum, vanadium, or  
25 boron.

49. The method of claim 47, wherein the second metal is silicon, titanium,  
aluminum, cerium, lithium, magnesium, calcium, lanthanum, beryllium, uranium, or  
thorium.